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**The Effect of Long-Term Admin. of Vanadyl
Sulfate on the Level of Certain Trace
Elements in the Blood & Urine of Rabbits**

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THE EFFECT OF LONG-TERM ADMINISTRATION OF VANADYL
SULFATE ON THE LEVEL OF CERTAIN TRACE ELEMENTS IN THE
BLOOD AND URINE OF RABBITS

[Vliyaniye dlitel'nogo vedeniya vanadil-sul'fata na
uroven' mekotorykh mikroelementov v krovi i moche
krolikov]

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Trudy Voronezhskoga (Gosudarstvennogo)
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THE EFFECT OF LONG-TERM ADMINISTRATION OF VANADYL
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BLOOD AND URINE OF RABBITS

L. M. Kopylova

Investigations were made of 15 healthy rabbits with the goal of studying the effect of vanadyl sulfate on the quantitative content of certain trace elements in the blood and urine of animals and of eliminating it from the organism. Vanadyl sulfate was administered subcutaneously to the animals over the course of the day for two months in a dose of 1 mg/kg weight. All of the investigations were carried out in dynamics, using the chemico-spectral method.

It was found that the amount of vanadium in the blood plasma was 4 times higher than the norm in the first month, and remained high throughout the course of the entire experiment (see Table 1).

One can see from the table provided that the content of nickel and manganese, whose level changes more in the plasma than in the erythrocytes, increases, in addition to the increase in vanadium. The amount of zinc slowly increased and approached the norm. The content of silver, copper, and particularly lead decreased in both the plasma and the erythrocytes. A low lead content in the blood was recorded until the end of observation.

TABLE 1. CONTENT OF TRACE ELEMENTS IN THE PLASMA AND ERYTHROCYTES
IN THE BLOOD OF RABBITS DURING THE ADMINISTRATION OF VANADYL
SULFATE

(μg per 10 g whole blood)

Stages of investigation	Investigated material	No. of investigations	Vanadium	Nickel	Zinc	Silver	Copper	Lead	Manganese
Before the experiment	Er* Pl**	15	1.56 ± 0.22 1.0 ± 0.1	5.75 ± 0.54 5.2 ± 0.33	470 ± 18.0 293 ± 21.0	1.02 ± 0.11 0.83 ± 0.06	37.5 ± 3.94 35.8 ± 2.36	15.9 ± 0.94 8.75 ± 0.40	4.1 ± 0.27 2.08 ± 0.21
Administration of vanadyl sulfate for 1 mo	Er Pl	12	1.28 ± 0.19 4.0 ± 0.42	6.8 ± 0.42 6.8 ± 0.75	480 ± 29.4 250 ± 13.3	0.66 ± 0.06 0.5 ± 0.06	26.0 ± 3.35 28.0 ± 4.9	9.6 ± 0.71 7.2 ± 0.6	5.25 ± 0.56 5.5 ± 0.9
For 2 mos	Er Pl	12	1.28 ± 0.19 1.96 ± 0.2	6.8 ± 0.42 7.3 ± 1.1	610 ± 30.4 336 ± 34.3	0.73 ± 0.1 0.86 ± 0.12	30.7 ± 3.06 33.2 ± 3.2	9.4 ± 0.79 6.7 ± 0.6	5.55 ± 0.66 5.7 ± 0.76
Observation, 3 months	Er Pl	6	1.62 ± 0.26 1.8 ± 0.21	6.8 ± 0.86 6.0 ± 0.96	440 ± 42.7 280 ± 46.9	0.45 ± 0.03 0.39 ± 0.03	22.0 ± 2.2 20.0 ± 2.0	10.0 ± 0.7 6.7 ± 0.46	4.8 ± 0.46 2.7 ± 0.4
4 months	Er Pl	6	1.53 ± 0.14 0.96 ± 0.18	6.5 ± 0.62 4.5 ± 0.30	400 ± 39.6 250 ± 17.4	0.87 ± 0.25 0.55 ± 0.03	26.0 ± 4.1 35.0 ± 3.62	11.6 ± 1.49 7.0 ± 0.73	4.7 ± 0.57 2.8 ± 0.4

* Er — erythrocytes; ** Pl — plasma.

In parallel with investigating the trace elements of the blood, we made a study of their content in the urine in the same animals. The results of the investigation are given in Table 2. The amount of vanadium in the urine increased during the experiment, which resulted in its partial elimination from the organism through the kidneys.

The content of nickel, zinc, and manganese in the urine remained stable. There was a clearly defined increase in the elimination of lead under the effect of the administered vanadyl sulfate throughout the entire experiment. We traced the elimination of vanadium from the animal organism over the first 5 days after terminating the administration of vanadyl sulfate to the rabbits. The largest amount

TABLE 2. CONTENT OF TRACE ELEMENTS IN THE URINE OF RABBITS
DURING THE ADMINISTRATION OF VANADYL SULFATE ($\mu\text{g}/\text{days}$)

Stages of the investigation	Nickel	Zinc	Silver	Copper
Administration of vanadyl sulfate before the experiment	4.65 ± 0.31	100 ± 4.7	0.3 ± 0.06	10.1 ± 0.91
1 month	4.07 ± 0.45	117 ± 9.4	0.17 ± 0.01	14.7 ± 2.1
2 months	4.17 ± 0.49	99 ± 9.7	0.18 ± 0.01	11.1 ± 1.1
Observation: 3 months	3.9 ± 0.7	106 ± 13	0.22 ± 0.23	12.2 ± 1.67
4 months	4.1 ± 1.0	107 ± 13.0	0.27 ± 0.01	9.2 ± 0.6

TABLE 2. (continued)

Stages of the investigation	Vanadium	Molybdenum	Lead	Manganese
Administration of vanadyl sulfate before the experiment	0.51 ± 0.03	7.0 ± 0.53	4.8 ± 0.51	4.1 ± 0.35
1 month	100.0 ± 0.96	2.4 ± 0.45	2.4 ± 0.45	4.7 ± 0.43
2 months	6.8 ± 1.79	1.17 ± 0.12	6.8 ± 0.73	4.1 ± 0.57
Observation: 3 months	0.58 ± 0.15	4.67 ± 0.1	4.87 ± 1.0	4.35 ± 0.76
4 months	0.52 ± 0.02	7.1 ± 0.56	4.5 ± 0.2	4.2 ± 0.7

vanadium is eliminated in the first 2 - 3 days. By the fifth day, its content in the urine approaches the norm. A certain relationship was noted between the level of vanadium in the urine and the content of the metal in the blood of the experimental rabbits.

Hence, the administration of vanadyl sulfate to the animal organism leads to restructuring of the metabolism of a number of trace elements. The shifts were noted in the change of trace elements similar to vanadium in their biological role in the organism. The level of nickel and manganese in the blood increased, and the amount of copper, silver, and lead decreased. The change in the content of trace elements occurs by means of their redistribution within the organism, since the elimination of metals from the organism was not detected by the author.

The elimination of vanadium from the animal organism occurs in the first 2 - 3 days after administering the preparation. An increase in the elimination of lead with the urine is noted. Since lead is an antagonist of vanadium, this can be considered a favorable factor.

The above indicated changes in the content of trace elements are caused by the administration of vanadyl sulfate, since the level of trace elements normalizes after terminating the experiment.

The obtained results reflect the interaction of vanadium with other trace elements in the living organism.

References

- Babenko, G. A. Mikroelementy v eksperimental'noy i klinicheskoy meditsine (Trace Elements in Experimental and Clinical Medicine). Kiev, 1965.
- Boynar, A. O. Biologicheskaya rol' mikroelementov v organizme zhivotnykh i cheloveka (The Biological Role of Trace Elements in the Organisms of Animals and Man). Moscow, 1960.
- Roshchin, L. V. Vanadiy i yego soyedineyya (Vanadium and Its Compounds). Moscow, 1968.